

Geometry Date_____ 1.3 Notes

Segments and their measure (pp 17–20)

In geometry, rules that are accepted without proof are called **postulates** or **axioms**. Rules that are proved are called *theorems*. In this lesson, you will study two postulates about the lengths of segments.

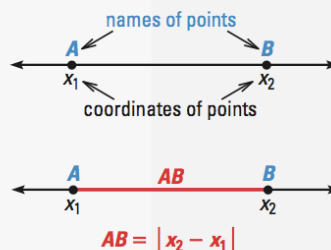
POSTULATE

POSTULATE 1 *Ruler Postulate*

The points on a line can be matched one to one with the real numbers. The real number that corresponds to a point is the **coordinate** of the point.

The **distance** between points A and B , written as AB , is the absolute value of the difference between the coordinates of A and B .

AB is also called the **length** of \overline{AB} .

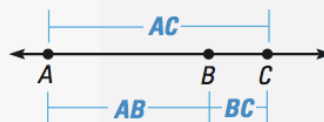


POSTULATE

POSTULATE 2 *Segment Addition Postulate*

If B is between A and C , then $AB + BC = AC$.

If $AB + BC = AC$, then B is between A and C .

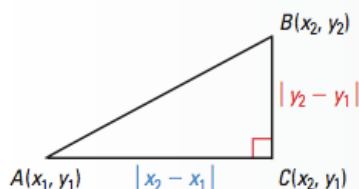


CONCEPT SUMMARY

DISTANCE FORMULA AND PYTHAGOREAN THEOREM

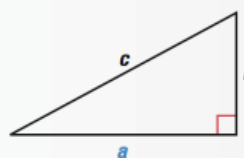
DISTANCE FORMULA

$$(AB)^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$



PYTHAGOREAN THEOREM

$$c^2 = a^2 + b^2$$



Segments that have the same length are called **congruent segments**. For instance, in Example 3, \overline{AB} and \overline{AD} are congruent because each has a length of $\sqrt{13}$. There is a special symbol, \cong , for indicating *congruence*.

LENGTHS ARE EQUAL.

$$AB = AD$$

“is equal to”

SEGMENTS ARE CONGRUENT.

$$\overline{AB} \cong \overline{AD}$$

“is congruent to”

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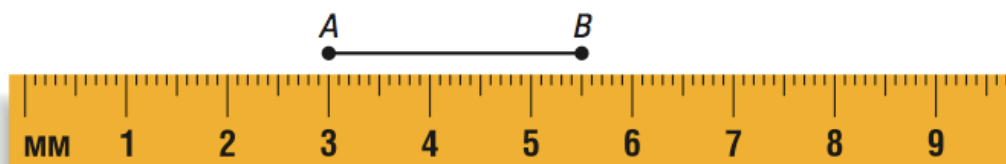
EXAMPLE 1 *Finding the Distance Between Two Points*

Measure the length of the segment to the nearest millimeter.



SOLUTION

Use a metric ruler. Align one mark of the ruler with A. Then estimate the coordinate of B. For example, if you align A with 3, B appears to align with 5.5.



$$AB = |5.5 - 3| = |2.5| = 2.5$$

► The distance between A and B is about 2.5 cm.

1. **Example:** Measure the length of the segment to the nearest millimeter.



2. Measure the length of the segment to the nearest millimeter.



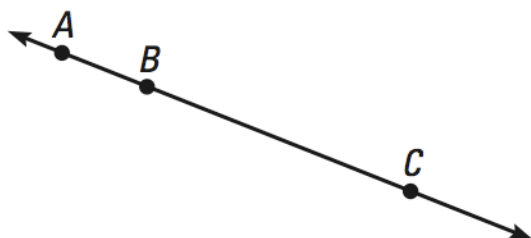
DRABBLE By Kevin Fagan



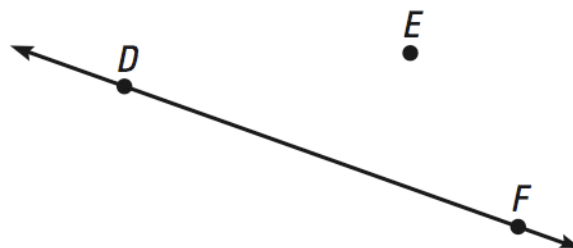
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When three points lie on a line, you can say that one of them is **between** the other two. This concept applies to collinear points only. For instance, in the figures below, point B is between points A and C , but point E is not between points D and F .



Point B is between points A and C .



Point E is not between points D and F .

EXAMPLE 2 Finding Distances on a Map



MAP READING Use the map to find the distances between the three cities that lie on a line.

SOLUTION

Using the scale on the map, you can estimate that the distance between Athens and Macon is

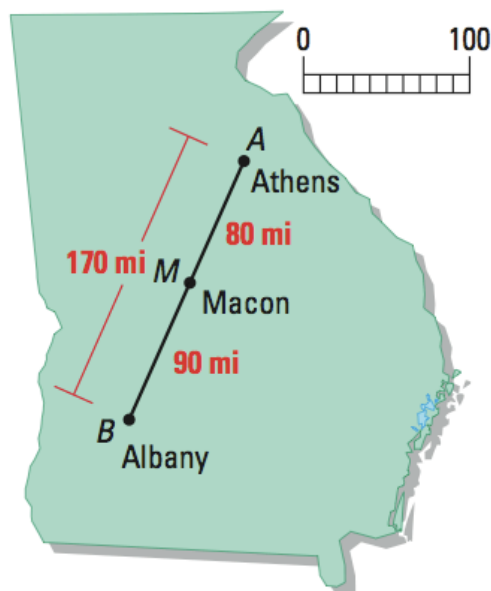
$$AM = 80 \text{ miles.}$$

The distance between Macon and Albany is

$$MB = 90 \text{ miles.}$$

Knowing that Athens, Macon, and Albany lie on the same line, you can use the Segment Addition Postulate to conclude that the distance between Athens and Albany is

$$AB = AM + MB = 80 + 90 = 170 \text{ miles.}$$



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3. Two friends leave their homes and walk in a straight line toward the other's home. When they meet, one has walked 425 yards and the other has walked 267 yards. How far apart are their homes?


4. A car with a trailer has a total length of 27 feet. If the trailer has a total length of 13 feet, how long is the car?



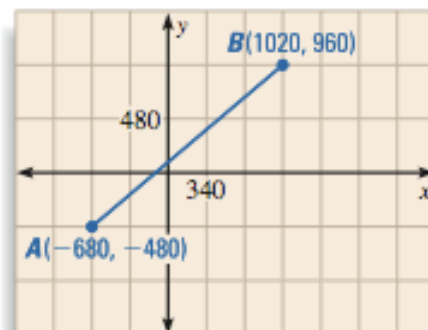
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EXAMPLE 4 Finding Distances on a City Map

 **MAP READING** On the map, the city blocks are 340 feet apart east-west and 480 feet apart north-south.

- Find the walking distance between A and B .
- What would the distance be if a diagonal street existed between the two points?



SOLUTION

- To walk from A to B , you would have to walk five blocks east and three blocks north.

$$5 \text{ blocks} \cdot 340 \frac{\text{feet}}{\text{block}} = 1700 \text{ feet}$$

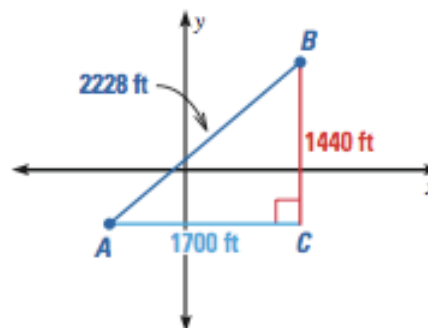
$$3 \text{ blocks} \cdot 480 \frac{\text{feet}}{\text{block}} = 1440 \text{ feet}$$

- So, the walking distance is $1700 + 1440$, which is a total of **3140** feet.

- To find the diagonal distance between A and B , use the Distance Formula.

$$\begin{aligned} AB &= \sqrt{[1020 - (-680)]^2 + [960 - (-480)]^2} \\ &= \sqrt{1700^2 + 1440^2} \\ &= \sqrt{4,963,600} \approx \mathbf{2228} \text{ feet} \end{aligned}$$

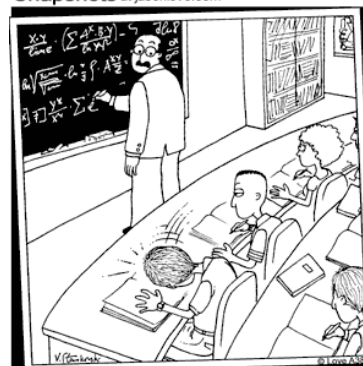
- So, the diagonal distance would be about 2228 feet, which is 912 feet less than the walking distance.



STUDENT HELP

► **Study Tip**
If you use a calculator to compute distances, use the parenthesis keys to group what needs to be squared.

Snapshots at jasonlove.com



Professor Herman stopped when he heard that unmistakable thud – another brain had imploded.

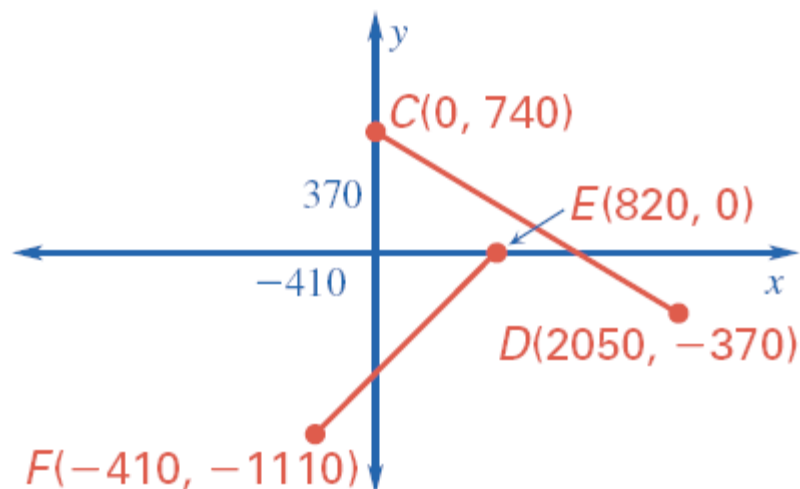
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On the map, the city blocks are 410 feet apart east–west and 370 feet apart north–south.

5. Find the walking distance between C and D.

6. What would the distance be if a diagonal street existed between the two points?

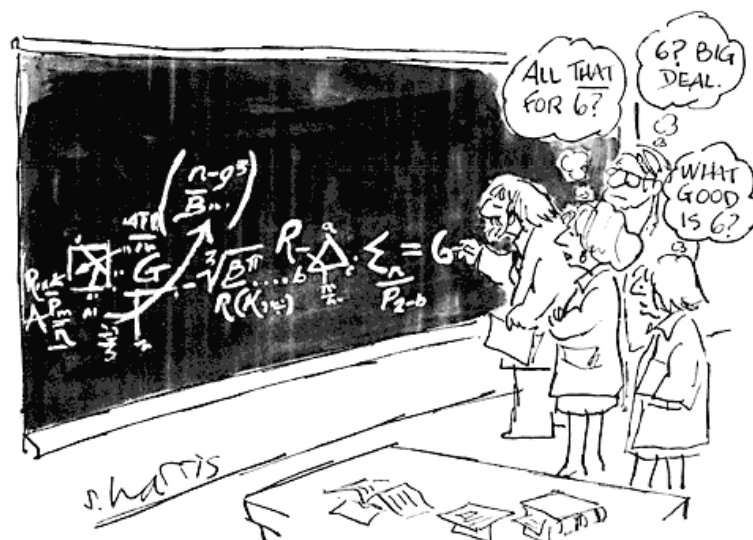


7. Find the diagonal distance between points E and F on the map.

The Distance Formula

(On Top of Old Smokey)

When finding the distance
Between two points,
Subtract the two x's
Do the same for the y's.
Now square both these numbers,
And find out their sum.
When you take the square root
Then you are all done!



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EXAMPLE 3 Using the Distance Formula

Find the lengths of the segments. Tell whether any of the segments have the same length.

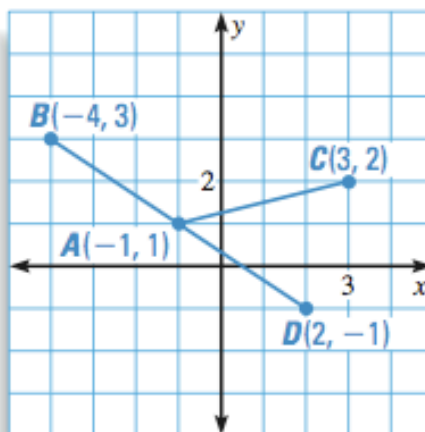
SOLUTION

Use the Distance Formula.

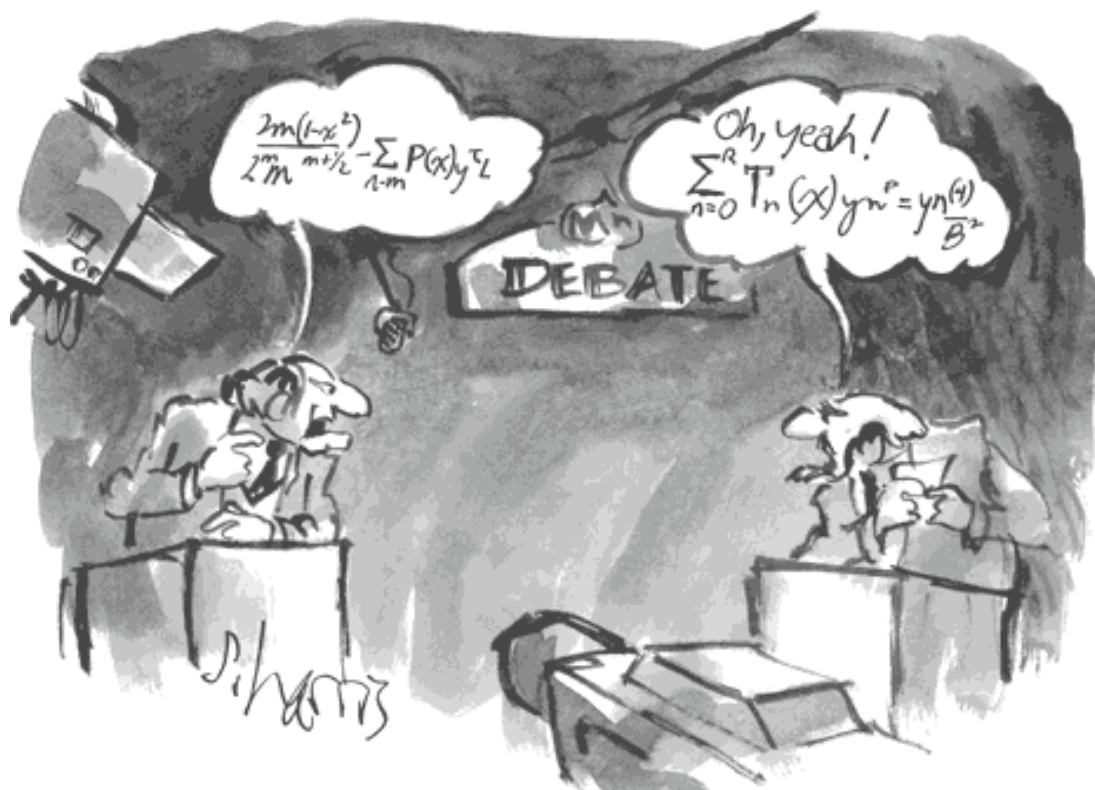
$$\begin{aligned} AB &= \sqrt{[(-4) - (-1)]^2 + (3 - 1)^2} \\ &= \sqrt{(-3)^2 + 2^2} = \sqrt{9 + 4} = \sqrt{13} \end{aligned}$$

$$\begin{aligned} AC &= \sqrt{[3 - (-1)]^2 + (2 - 1)^2} \\ &= \sqrt{4^2 + 1^2} = \sqrt{16 + 1} = \sqrt{17} \end{aligned}$$

$$\begin{aligned} AD &= \sqrt{[2 - (-1)]^2 + (-1 - 1)^2} \\ &= \sqrt{3^2 + (-2)^2} = \sqrt{9 + 4} = \sqrt{13} \end{aligned}$$

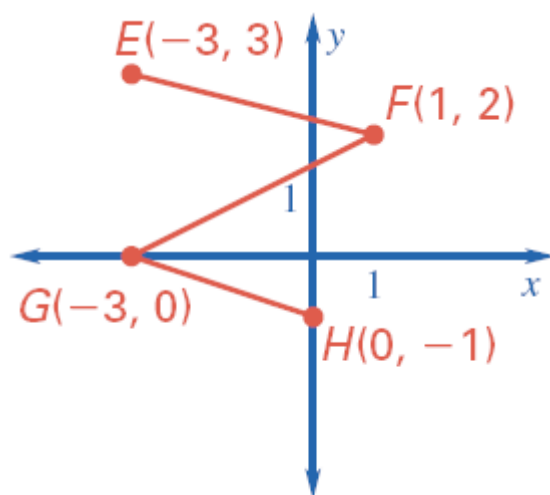


► So, \overline{AB} and \overline{AD} have the same length, but \overline{AC} has a different length.

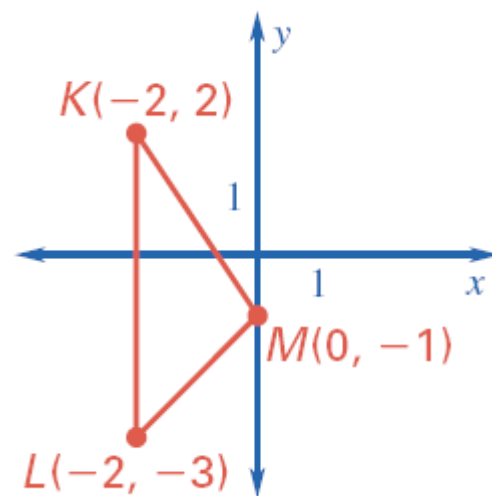


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8. Find the lengths of the segments. Tell whether any of the segments have the same length.



9. Find the distance between each pair of points.



10. What is a postulate?

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12. Use the diagram. How can you determine BD if you know BC and CD? if you know AB and AD?



$J(10, 2)$

13. Use the Distance Formula to decide whether $\overline{JK} \cong \overline{KL}$: $K(7, -3)$

$L(4, -8)$



"Let's see now. Wilkes is nine years younger than Gottlieb, and Gottlieb is one-third older than me. Foster's age minus Rivera's age..."